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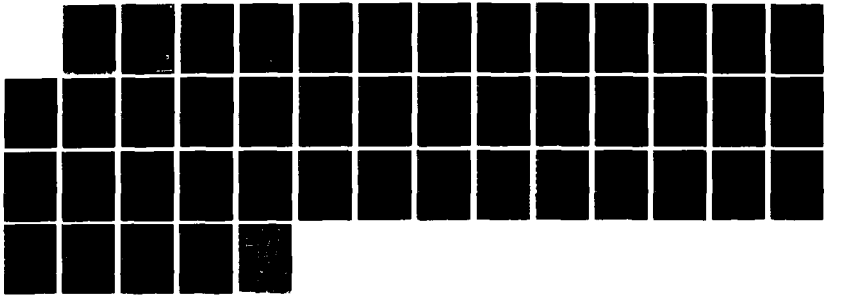

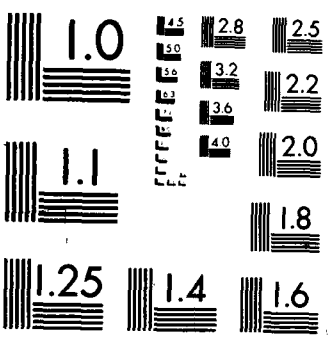
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NKF Report No.
7103-001/4

FIBER OPTIC ENGINEERING SENSOR SYSTEM

PROGRAM MANAGEMENT PLAN

PREPARED IN RESPONSE TO:

CONTRACT NO. N00014-87-C-2032

PRESENTED TO:

FIBER OPTICS TECHNOLOGY PROGRAM OFFICE
NAVAL RESEARCH LABORATORY
WASHINGTON, DC 20375-5000

PRESENTED BY:

NKF ENGINEERING, INC.
12200 SUNRISE VALLEY DRIVE
RESTON, VIRGINIA 22091

APRIL 1987

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PROGRAM MANAGEMENT PLAN

FOR CONTRACT NO. N00014-87-C-2032

FIBER OPTIC ENGINEERING SENSOR SYSTEM

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to outline operating procedures and responsibilities of participants in Contract No. N00014-87-C-2032 between the Naval Research Laboratory (NRL) and NKF Engineering, Inc. (NKF), the prime contractor and to describe NKF's plans for accomplishment and management of this effort.

1.2 BACKGROUND

The principal objective of this program is to develop a fiber optic engineering sensor system (FOESS) including sensors, telemetry, and displays for applications such as damage control, system control (i.e., propulsion or steering) and intrusion defense systems for ship, aircraft and shore applications. This objective will be achieved by research and engineering effort conducted in four contractually defined phases.

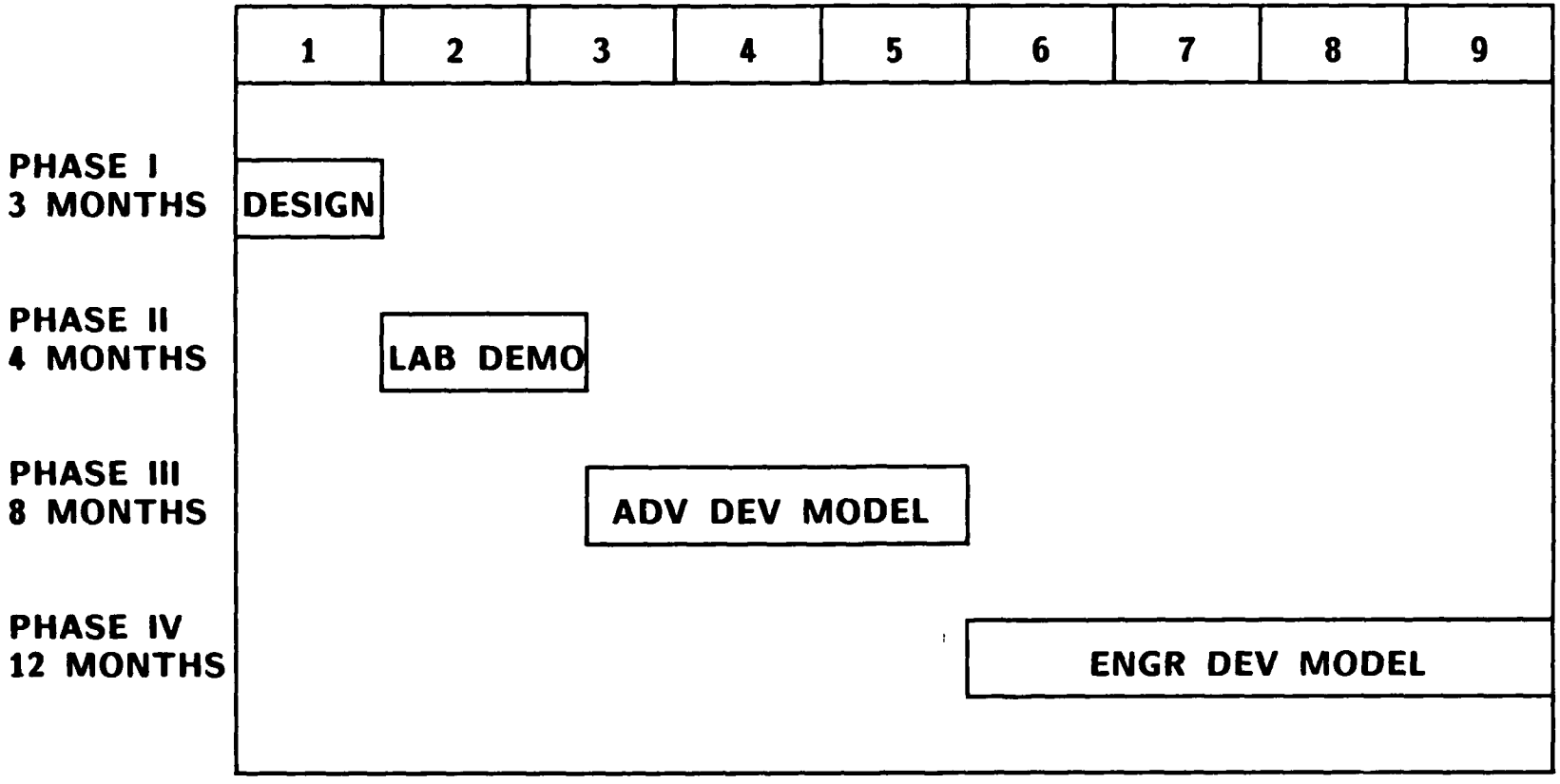
NRL issued a competitive solicitation on 19 May 1986 for professional engineering and technical services required to undertake this effort. In response to this solicitation, NKF and its subcontractor, Applied Remote Technology, Inc. (ART), submitted a proposal on 27 June 1986.

On 31 December 1986, following the source selection process, NKF was awarded Contract No. N00014-87-C-2032 for Phase I of the program; the phase schedule for the FOESS program is shown at Figure 1 (page 2). Accordingly, during the period of the Contract NKF shall provide professional engineering and technical services to accomplish the Contract Statement of Work (SOW), reproduced for convenience at Appendix A.

NKF, with corporate headquarters located at 12200 Sunrise Valley Drive, Reston, Virginia 22091 is the prime contractor for this contract. The Program Office for this effort is located at NKF's Washington Branch Office at One Crystal Park, Suite 1100, 2011 Crystal Drive, Arlington, Virginia 22202. The managerial and engineering services required for contract performance will be provided through key personnel of NKF and its subcontractor, Applied Remote Technology, Inc. (ART), whose office is located at 9950 Scripps Lake Drive, Suite 104, San Diego, California 92131.

FIGURE 1 - FOESS PHASE SCHEDULE

QUARTERS AFTER CONTRACT AWARD



2.0 PHASE I CONCEPT DESIGN

2.1 METHODOLOGY OF CONCEPT DESIGN

NKF will achieve the objective of this contract by dividing the effort into three interrelated phases: Existing System Evaluation, FOESS Concept Design, and a Trade-off Analysis. These activities are described below; they are included in the Work Breakdown Structure (Appendix B) and their schedules are shown in the Phase I Milestone Chart (Appendix C).

2.2 EXISTING SYSTEM EVALUATION

This evaluation will be conducted in three interrelated subphases.

2.2.1 Description of Current Systems

Two sensors will be identified from each of the three categories of sensors; Damage Control, Engineering Control, and Intrusion Detection. The information to be collected where available on these six sensors will include:

- o Operational Factors
  - Performance
  - Reliability
  - Survivability
  - Maintainability
  - Training Requirements
- o Installation Factors
  - Cabling and Routing
  - Sensor Quantity and Location
  - Methods and Skills Requirements
  - Cost

2.2.2 Extract FOESS Requirements

Based upon the data collected above on the selected sensors, operational requirements for the FOESS sensors will be selected:

- o Sensors - the types, characteristics, and quantities needed for a demonstration of the basic FOESS concept will be listed.
- o Telemetry - this involves getting the optical signals to and from the fiber optic sensors and the control stations. The needed data includes the location of the sensors, displays, and control stations and their associated signal pathways and path lengths.
- o Controls & Displays
  The operational factors of the control and display functions will be compiled regarding the methods of controlling the FOESS network and displaying and operating on the data collected by the sensors.

2.2.3 Data Base for Trade-Off Evaluation

Based upon the data in Section 2.2.1 above and the FOESS requirements defined in Section 2.2.2, establish a data base to be used as a baseline for trading off the existing sensor systems with the characteristics of the FOESS Concept Design.

2.2 FOESS CONCEPT DESIGN

The FOESS concept design is divided into three design phases and a design integration phase. The first phase generates the concept design of the fiber optic Universal Sensor And Signal (USAS) Network that will be the basis of the FOESS. The second phase will deal with the fiber optic sensors to be used in the FOESS and the third with the Controls and Displays aspects of the FOESS data. The fourth phase integrates these three aspects of the FOESS into a single design data package.

2.3.1 USAS Concept Design

The USAS concept design will proceed in three steps. The first step is to select the USAS network topologies. This will be done by identifying and characterizing candidate topologies with regard to network capacity and growth factors, operational redundancy and degradation, system reliability and safety, human factors, and cost and installation. From this, a candidate topology will be selected based upon fiber optic considerations and general Navy requirements.

The second step is to identify, survey for and specify the fiber optic components needed for the USAS. The fiberoptics components will include:

- o Fibers and Cables
- o Emitters and Detectors
- o Connectors and Splices
- o Dichroic Coupler/Connector
- o Power Splitting Couplers.

A survey will be carried out of existing, commercially available fiber optic components to identify those specific components that meet the needs of the USAS network and Navy operational considerations. Wherever practical, Mil Qualified components will be selected but all components will be reviewed based upon their performance characteristics, cost and availability, and any personnel skills required for their use (e.g., terminations). Based upon this survey, existing components will be selected for the USAS network. Wherever necessary, FOESS specific components will be conceptually designed.

The third step of the USAS concept design will be to incorporate the selected fiber optic components into the selected USAS topology and generate the network design. The results of this will be the establishment of a design procedure with which general optical performance specifications and installation requirements will then be applied to the design procedure, generating the final USAS network design.

2.3.2 FOESS Sensor Design

The design of the FOESS sensors is divided into three steps. The first step surveys existing fiber optic sensor technology for candidate sensor schemes. The second step analyzes each of these and selects one sensing function to serve as the basis of the FOESS sensors. The third then specifies the basic fiber optic sensor designs so as to meet the FOESS specifications regarding the sensing transform function and operational suitability. These sensors will be made up of two modules. The first module will be the same for all sensors and is the basic general purpose, optical transducer which optically interfaces to the FOESS system. The second module is specialized for each type of sensor and converts the parameter being sensed into a form that interfaces with the basic transducer (e.g., temperature into displacement). The converter also serves as the mechanical adapter so that the transducer can be properly mounted to each specific application. Both the transducer and converter module will be configured to meet the shipboard requirements concerning environment, packaging, etc.

2.3.3 FOESS Control and Display Concept Design

The concept design for the controls and displays is separated into FOESS man-machine requirements and FOESS data acquisition and signal processing.

The man-machine interface deals with those functions normally encountered by the system operator, i.e., those things "in front of the switchboard." It is known that the plethora of present-day alarms and warning systems in the shipboard environment makes current operating and maintenance procedures cumbersome and requires operators, often under stress, to remember many actions and drills in response. Another shortcoming is that many current systems are inclined to generate false alarms so frequently that they are considered technically irresponsible and are often over-ridden or ignored by operators.

From the Current Systems Analysis the NKF team will identify precisely the requirements for improvement and design a conceptual FOESS which will achieve systems reliability, compatibility with the shipboard environment and ease of maintenance and operation. The hardware and software components required for associated controls and displays to complement the man-machine interface will be defined.

The data acquisition and signal processing portions of the FOESS concept design addresses the electro-optic and electronic aspects of the FOESS; namely the control of the optical signals to and from the fiber optic sensors, the data acquisition of those signals for status monitoring purposes, and the electronic signal processing and software needed for that acquired data to interface with controls and displays in the man-machine interface.

2.3.4 System Design Integration

The resultant conceptual designs and specifications for the USAS, fiber optic sensors, and display and control will be integrated into the system design review package for presentation to the sponsor. In the course of this task, critical design issues will be identified that warrant further investigation.

2.4 TRADE-OFF ANALYSIS

The aim of this analysis is to provide the lowest total life-cycle cost plan. Having made a trade-off analysis of various types of fiber optic sensors and derived a cost, performance and maintenance baseline for existing sensor systems, NKF will compare these factors to demonstrate the relative viability of the FOESS.

The contractor intends to approach this element of the design activity using four interrelated steps.

2.4.1 Definition of Notional Current System

The functions and components of present systems will be separated under these headings:

- o Damage Control, Systems Control, and Intrusion Defense Sensors
- o Telemetry
- o Displays
- o Alarm Signals

and the following aspects of each function or component will be examined:

- o Performance
- o Reliability
- o Cost
- o Standardization
- o Identified shortcomings
- o Technical risk.

2.4.2 Derivation of FOESS Data

The aspects of the FOESS design to be examined will match those above, namely:

- o Performance
- o Reliability
- o Cost
- o Standardization
- o Identified shortcomings
- o Technical risk.

2.4.3 Concept Design Upgrade

Wherever practical, the FOESS design and its review package will be upgraded to correct for any design shortfalls discovered during the tradeoff.

3.0 PHASES II - IV

The output of Phase I of NRL's program will lead to:

- o Phase II - the development of a Laboratory Demonstration Model of a FOESS and other associated components
- o Phase III - the development of an Advanced Development Model of a FOESS
- o Phase IV - the development of an Engineering Development Model of a FOESS.

The objectives of each Phase are shown in the following paragraphs and their schedules are at Appendix D.

3.1 PHASE OBJECTIVES

3.1.1 Phase II - Laboratory Demonstration Model (LDM)

The LDM will be a brassboard of the conceptual design developed in Phase I. It will be designed in accordance with the System Design Review Data Package approved for the conceptual design and fabricated in accordance with drawings developed to document LDM design details. It will be tested to demonstrate performance characteristics of the USAS network and system interface, using test procedures developed by NKF/ART and approved in Phase I. A further objective of testing will be to assess the feasibility of the design approach.

3.1.2 Phase III - Advanced Development Model (ADM)

The ADM will be the implementation of the design approved following the Preliminary Design Review held in Phase II. It will consist of:

- Optical sensors optimized and packaged for a naval application
- Telemetry composed of military qualified components to the maximum extent possible and configured in a network that meets naval operational system requirements
- Electronic and optical interface devices capable of connecting the ADM to existing equipment and existing sensors and of being packaged for the planned environment.

The capability of the ADM telemetry subsystem will be demonstrated to ensure it meets the performance requirements with a full complement of sensors of the types applicable to the sensor system under development. The ADM will be tested in accordance with NRL approved test plans and procedures.

3.1.3 Phase IV - Engineering Development Model (EDM)

The EDM will be the implementation of the design approved following the Critical Design Review held in Phase III, in a configuration which will comply with form, fit and function requirements for shipboard use. It will have functional and physical interface compatibility with the damage control, propulsion control or other ship's equipment interface for the sensor signals for the type of sensor system under development. The EDM will be tested in accordance with the test plan and procedures approved by NRL for Phase IV and meet all requirements for laboratory and shipboard tests. After design, fabrication, and test it will be delivered to a naval platform in a deployable, though not yet military qualified, configuration. It will then be installed and tested and appropriate documentation and logistical support will be provided.

3.1.4 Material

In all Phases, military qualified parts will be used to the maximum extent possible and for Phases III and IV components, the best standard industrial packaging practices will be employed.

4.0 PROGRAM MANAGEMENT

4.1 PROJECT CONTROL SYSTEM

A project control system has been activated for the performance of the FOESS Phase I effort which will provide for timely recognition of and reaction to the three types of challenge (technical, schedule and financial) that may arise. The system will generate the information needed to ensure the technical excellence of all work performed and deliverables submitted, that effort is correctly assigned on or before schedule, and that work is completed in the most resource-efficient manner possible within specified man-hour and cost constraints.

The system, which is described more fully below, is derived from that used by NKF for all contract effort and will be employed if NKF is selected for subsequent phases of the FOESS program.

4.1.1 Technical Control

The NKF Program Manager will maintain close liaison with NRL to provide clear visibility of task progress and to identify any perceived or anticipated technical problems. Complete documentation of NKF's technical efforts, significant accomplishments, results, and problem areas will be provided in the technical section of the monthly progress report for ongoing work; these reports will be prepared by the Program Office and approved by the Program Manager.

In NKF's FOESS contract activity, in-house technical reviews of work efforts will be conducted to ensure management visibility, as well as formal technical reviews for clients. The frequency of such reviews will be governed by the scope and intensity of the work. Given the technological challenge and schedule constraints of the FOESS task, NKF has established an Executive Review Panel of senior management and technical specialists who will be available to assist the Program Manager in review and reading technical management issues of particular criticality.

All task deliverables will be prepared under the direct supervision of the Program Manager. Also, all contract deliverables will be reviewed by NKF's Deliverable Quality Assurance Controller to ensure they conform to a suitable quality standard for submittal to NRL.

4.1.2 Schedule Control

Close control will be exercised so that schedule impacts associated with technical problems are readily identified and resolved as they arise.

4.1.3 Financial Control

Financial records (man-hours and dollars) for all work are maintained by NKF's corporate administrative staff, utilizing a computer-based cost control system. As for every contract undertaken by NKF, the FOESS contract has been assigned a unique NKF job number to permit separate tracking. The financial records for all ongoing work will be updated weekly. The reports will contain cumulative expenditures of man-hours, direct labor dollars, and other direct costs (e.g., travel, computer usage, etc.); the remaining man-hours, direct labor dollars, and other direct cost budget; cumulative man-hour and dollar expenditures as percentages of authorized ceiling values for the task; and a comparison of budgeted, actual, and remainder-to-completion average labor rates. Financial problems will be recognizable immediately if actual expenditures tend to depart from planned/budget values. This will enable the NKF Program Manager to take corrective measures in a timely manner.

4.1.4 Management Information System

NKF will implement a management information system to support the overall program, including subcontractor activities. This system has been designed to facilitate efficient communications as follows:

- o Systematic and ad hoc reporting on program status to NRL by NKF as Prime Contractor.
- o Prompt internal reporting of program activities.
- o Electronic data exchange with ART and electronic mail exchange with NRL and ART.

4.2 PROGRAM OFFICE

NKF has assigned John T. Jenkins as Program Manager to head a team of key personnel. He will act as the counterpart to NRL's COTR to ensure that all aspects of NKF's performance in this contract, including all cost, technical and schedule control, are in accordance with the provisions of the contract and with NRL directives. In accordance with NRL directives, NKF has given the Program Manager full access to all corporate resources and support personnel that may be required for the successful performance of this contract effort. The Program Manager is fully responsible for contract performance to John J. Turner, NKF Senior Vice President, and will report directly to him.

Other key personnel assigned to support the Program Manager, with responsibility for providing all necessary engineering and technical services required by the contract, include Charles S. Slemon (ART), Design Engineer and Richard E. Buteux (NKF), System Engineer.

TABLE 1 (page 11) summarizes individuals' responsibilities and FIGURE 2 (page 12) depicts the lines of control of the organization established in support of this contract.

4.3 KEY GOVERNMENT CONTRACT PARTICIPANTS

4.3.1 Contracting Officer

The NRL Contracting Officer for this contract is John H. Ablard, Code 1230. His office is in Room 130 of NRL Building 222, telephone (202)767-5227.

4.3.2 Contracts Specialist

The Contracts Specialist for this contract is Vickie Chesley, Code 1232.VC. Her office is in Room 115 of NRL Building 222, telephone (202)767-2021.

4.3.3 Contracting Officer's Technical Representative (COTR)

The Contracting Officer's Technical Representative for this contract is John E. Donovan, Code 6503.1, Head of Fiber Optics Technology Program Office. His office is located in Room 208 of NRL Building 1, telephone (202)767-2174.

4.3.4 Contract Monitor

The Contract Monitor for this contract is Martin L. Musselman, Code 6503.4, Head of Special Projects. His office is located in Room 208 of NRL Building 1, telephone (202)767-3307.

4.3.5 Other Contracting Officer's Assistants

The Contracting Officer's Security Specialist for this contract is NRL Code 1221, telephone (202)767-2240.

The Contracting Officer's representative for Inspection and Acceptance for this contract, including invoicing, is Code 1235, telephone (202)767-3782.

Patent matters will be referred to Dr. Sal Sheinbein, Code 2004, telephone (202)767-3437.

4.4 NKF/GOVERNMENT INTERFACES

4.4.1 Communications

Effective communications between key participants in the contract are necessary to ensure timely response to the Navy's needs. Inherently, the requirement is to keep all parties informed, avoid surprises for senior management personnel and to head off potential problems or controversies before they can develop. The NKF Program Manager will keep the COTR informed of significant developments on a regular basis. In turn, the COTR will relay instructions and administrative and coordination requirements to the NKF team through the NKF Program Manager.

The Rapicom 120 Facsimile Transfer unit and the NKF VAX 11/780 computer using MASS-11 software compatible to NRL and ART's equipment, will both be used for the transfer of mail and other documents. Transfers will be initiated during evenings where practical to effect economy in telephone costs.

While telephonic and other forms of oral communications are appropriate in some situations, primary emphasis will be placed on written communication. Discipline is required in this regard and the Navy Correspondence Manual (SECNAVINST 5216.5C dated 24 August 1983) will be used by NKF as a guide to developing simple yet efficient writing styles.

A Telecon report form will be completed by contractor personnel as a record of all telephone discussions between key participants relating to technical matters concerning this contract.

4.4.2 Progress Review Meetings

NKF will hold monthly progress review meetings with the COTR (see Schedule, Appendix C), and will present the following items of information:

- o Status of all Key Program Elements
- o Financial Status
- o Near and Mid-term Objectives for Upcoming Period
- o Action Items
- o Areas of Concern
- o Recommendations.

TABLE 1 - KEY CONTRACTOR PARTICIPANTS AND RESPONSIBILITIES

NKF

J. J. Turner	Senior Vice President	Line organization support to NKF Fiber Optic Engineering Sensor System Program Office. Point of contact for NRL liaison with NKF Corporate Management.
J. T. Jenkins	Program Manager	Program direction, supervision of all program efforts, point of contact for liaison with NRL.
R. E. Buteux	System Engineer	Technical support to the Phase I Existing Sensor evaluation and trade-off analysis. Responsible in later Phases for coordination of T&E Programs, operations of maintenance instructions, ILS, CM and R&M.
S. Feldman	Quality Assurance Controller	Review of all contract deliverables to ensure compliance with contract requirements and technical excellence.
J. W. Maslin	Vice President Finance	Corporate Financial control.
K. Williams-Miller	Contract Administrator	Contract Administration.
R. D. Liptrap	Security Officer	Coordination of security requirements.

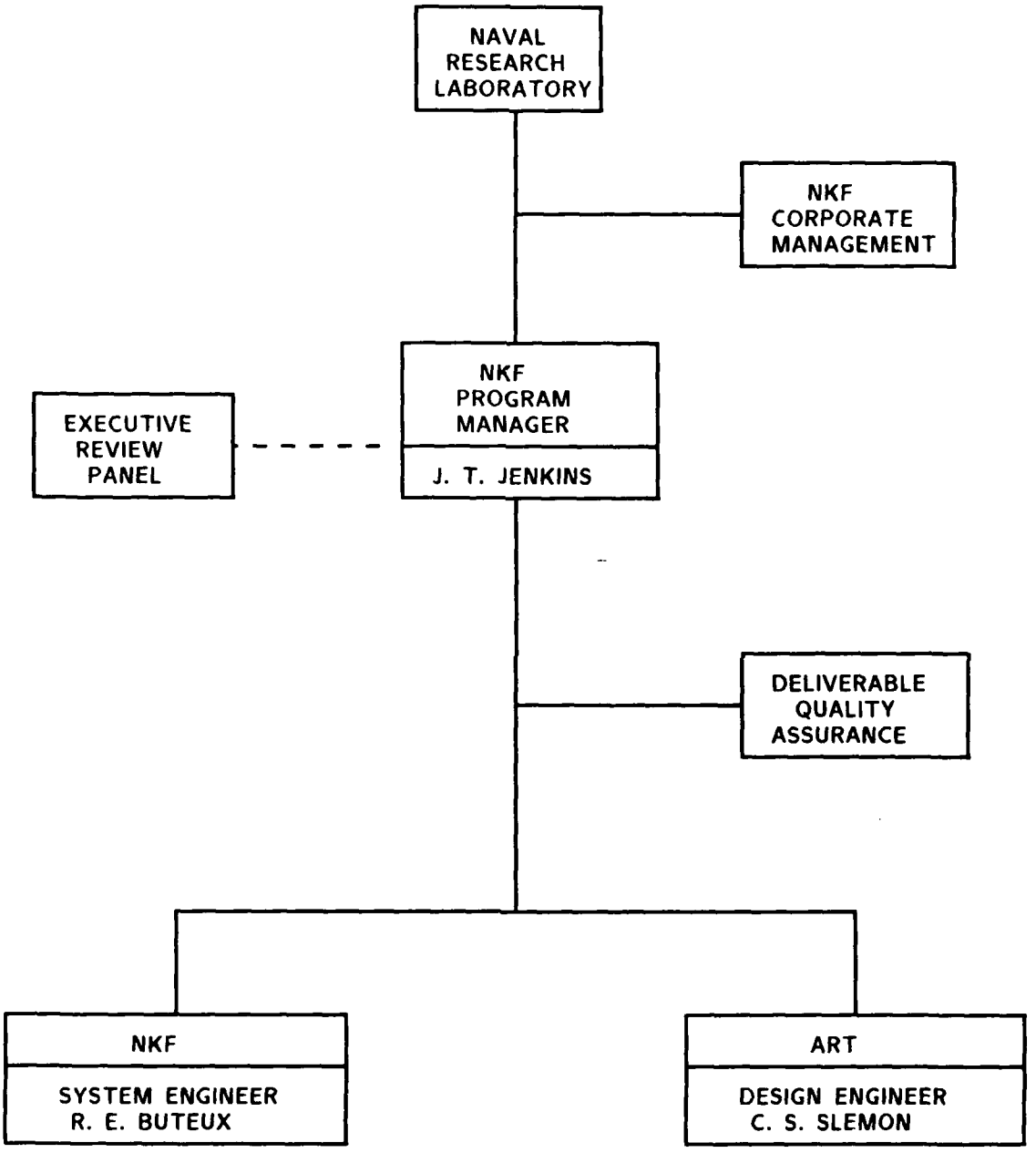
ART

C. S. Slemon	Design Engineer	Design engineering of the Fiber Optic Engineering Service System and development of Phases II, III and IV Models.
D. A. Neuschuler	Test/Logistics Designer	Development and application of test procedures and support ILSP and Maintainability Phase.

NKF/ART Executive Review Panel

J.J. Turner	NKF	Technical guidance in critical issue resolution.
J.W. Abbott	NKF	
R. Walrod	ART	
D.C. White	ART	

FIGURE 2 - CONTRACTOR LINES OF CONTROL



4.5 REPORTS

4.5.1 Reports Required

All deliverable products required by the FOESS Phase I contract take the form of reports, listed as follows:

- o Progress Reports (2)
- o Monthly Cost Reports (3)
- o Design Review Data Package - preliminary and final
- o Design Review Report
- o Final Report.

These are specified in the Contract Deliverables Requirements List and are shown in the Milestone Schedule (Appendix C).

4.5.2 Report Preparation and Content

All reports will be prepared in conformance with the format requirements contained in the Data Item Description referenced by the CDRL. Where format is not specified, reports will be prepared in accordance with the NKF Technical Instruction on "Standard Format of NKF Technical Reports" dated 16 December 1985. In summary, the content of each report will be as follows:

- o Progress Reports. These will be provided monthly by letter and will include a section specifically addressing schedule and status, as well as sections outlining work accomplished and planned for each reporting period; interim and preliminary design results and conclusions; problems or delays encountered or anticipated; and proposed solutions to any potential problem areas. These reports will provide regular opportunities for all interested parties to detect schedule problems and initiate corrective action. The detection of schedule problems will be facilitated by comparing actual accomplishments and the planned schedule developed at the beginning of the work and by comparing the technical effort performed each month (as documented in the Monthly Progress Reports) with the work planned for that period. Two such monthly reports will be provided during the Phase I timeframe.

- o Monthly Cost Reports. These reports, of which there shall be three during the Phase I timeframe, will include indication of all labor expenditures (reflecting person, hours worked, cost); materials (description, cost and use on contract); and travel (traveler, date of travel, reason for trip and cost).

- o Design Review Data Package. This will include plans, procedures, drawings, specifications and the results of analyses, tradeoffs and tests applicable to the FOESS Phase I effort.

- o Design Review Report. NKF will prepare program review documentation and conduct a System Design Review to report the results of Phase I and to recommend one or more conceptual designs that can be implemented within the overall program timeframe.

- o Final Report. This technical report will include a comprehensive interpretation of findings on this contract and will be provided within 30 days of the contract's completion.

4.5.3 Reports Review

The principle of complete staff action shall govern NKF's conduct of business with NRL. All reports, whether for preliminary review or final issue, will be subjected to a comprehensive NKF review. NKF will use a deliverable tracking system to assure the timeliness of all scheduled product deliveries. When extensive and formalized review of NKF technical reports by NRL is directed by the COTR, a three-stage review cycle is intended. In summary, the process consists of the Preliminary Draft Review Stage, the Adjudication Stage and the Final Draft Review Stage, as follows:

- o Preliminary Draft Review
  - NKF submits first draft to COTR
  - COTR checks draft's suitability for Preliminary Draft Review.
  - COTR notifies NKF of number of draft copies required and arranges schedule for review by NRL personnel.
- o Adjudication
  - Review comments are consolidated.
  - An adjudication meeting, attended by COTR, NKF and relevant reviewers, determines which review comments should form revisions to the first draft.
  - Agreed revisions are entered into the draft to form the "Master Mark-up."
  - Written adjudication minutes reflecting accepted comments are passed to NKF and COTR. These minutes will, in many cases, refer to the "Master Mark-up."
  - Upon COTR's approval of the minutes, NKF revises the draft document, incorporating all specified comments and resubmits the product for the next stage of review.
- o Final Draft Review
  - COTR verifies the corrected draft document against the Adjudication minutes and "Master Mark-up."
  - COTR, once satisfied with the document, notifies NKF to proceed with submission of the final deliverable, indicating the appropriate number of copies required.

4.5.4 Reports Submittal

Government acceptance of contract deliverables is signified by COTR signature of FORM DD250. A form DD250 will be submitted to NRL with the delivery of the Final Technical Report.

4.6 ADMINISTRATION

4.6.1 Contracting Officer

Any change to the provisions of the contract must be approved by the Contracting Officer.

4.6.2 Contract Files

NKF will maintain an individual file jacket for each phase, maintaining a complete file which contains the following:

- o Phase SOW
- o Draft and final deliverables
- o DD 250's
- o Other pertinent information

The NKF Program Manager will also maintain a complete file of COTR meeting reports, DD 254's, travel clearances and visit requests. These files will be maintained such that they are always available for audit.

4.6.3 Personal Services

The NKF Program Manager and the COTR will ensure that the performance of this contract does not involve personal services.

Federal Acquisition Regulations define "personal services contracting" as the procuring of services by contract in such a manner that the contractor or his employees are in effect employees of the government. Except as authorized by express statutory authority, the Civil Service laws and regulations and the Classification Act are not to be circumscribed through the medium of "personal services contracting." To do so is illegal.

4.6.4 On-site personnel

NKF personnel will not conduct on-site work exceeding 10 hours per week unless expressly approved by NRL in accordance with existing directives.

4.6.5 Security

All activity under this contract shall conform to the requirements of the Contract Security Classification Specification (DD 254) and the Industrial Security Manual for safeguarding classified information, DOD 5220.22M, dated March 1984.

In the preparation of technical reports, NKF and subcontractor personnel shall be guided by the DD Form 254 attachments and supplements, as appropriate, to provide classification specifications. Originators (authors) of reports will be cautioned to be mindful of the impact on classification resulting from combining separate elements of information in the report.

NKF is aware of the necessity for vigilance against inadvertently disclosing NRL technology.

4.6.6 Use of Contractor Facilities

NKF team conference rooms are available for use by NRL personnel in connection with meetings required for work assigned under the contract.

4.6.7 Travel

The COTR shall be advised during the monthly COTR reviews of all non-local travel required by the NKF team under the contract.

All foreign travel shall be approved in writing by the COTR prior to its commencement.

4.6.8 Procurement of Equipment

The contract provides for no Government furnished equipment. Thus, all procurements to support this contract must be funded by contract monies.

4.7 SUBCONTRACTING

A subcontract for elements of this effort has been established with Applied Remote Technology, Inc. (ART). The specific areas of ART's technical involvement are described in Section 2 above. Comprehensive integrated liaison procedures have been established to govern the interrelationship between NKF and ART.

Deliverables produced by ART under this contract will be delivered under the supervision and management control of the NKF Program Manager. No deliverable products will be submitted to NRL by ART. All contract products, including those suggested by ART, will be submitted to the government by NKF following the review procedures already discussed. All contractual liaison with NRL will be made by the NKF personnel described earlier. ART's cost and technical progress will be reported to the government as an integrated element of NKF's Monthly Report.

5.0 OVERALL ASSURANCE

The NKF team recognizes that the objectives of all Phases will be met by the delivery to NRL of all data, designs and models of the highest quality commensurate with the stipulations of the contract and the directions of NRL. The team intends to achieve this in Phase I and would undertake the subsequent Phases, achieving their successful completion, on schedule and within budgetary limits, by application of their proven management and technical expertise.

Appendix A

FOESS

CONTRACT STATEMENT OF WORK

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C-1. The work and services to be performed hereunder shall be subject to the requirements and standards contained in the attached Exhibits, the Statement of Work (Attachment No. 1) which is incorporated into Section C by reference, and the following Specifications:

PHASE I

Item 0001AA Fiber Optic Engineering Sensor System Conceptual Design

The fiber optic engineering sensor system conceptual design shall specify performance requirements, describe the design approach, evaluate cost and technical risks, and identify trade-offs and specific risk limiting alternatives for a system meeting the following requirements:

1. The system shall be suitable for application to Naval ship, aircraft or shore platforms to obtain a demonstrable benefit over an existing sensor system i.e., improved performance, lower cost, smaller size and weight, longer operating life, reduced vulnerability to electromagnetic interference.

2. The system shall contain the following major components or their functional equivalents:

(a) Fiber optic sensors for one or more of the following categories - damage control, system control (i.e., propulsion or steering), or intrusion defense.

(b) An optical telemetry link capable of providing the communication link between sensor interface device and the system interface device.

(c) The necessary optical and electrical interface devices including a sensor interface device to condition and multiplex sensor signals to the telemetry subsystem, and a system interface device to demultiplex the telemetry link and condition the signals for interface with the control system console's circuits for alarm or display.

3. The Contractor shall address the multiplex techniques and telemetry schemes considered in arriving at the conceptual design and discuss the limitations on the number and types of sensors that may be used in the system.

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT (CONT'D)

PHASE II - OPTION 1

Item 0001AB Data for Item 0001AA

The data to be furnished hereunder shall be prepared in accordance with the Contract Data Requirements List, DD Form 1423, Exhibit A attached hereto.

Item 0002AA Engineering Sensor System Laboratory Demonstration Model

The laboratory demonstration model (LDM) shall be a brassboard of the engineering sensor system conceptual design developed by the contractor in Phase I of this contract. The LDM shall be designed in accordance with the System Design Review Data Package approved for the conceptual design and fabricated in accordance with drawings developed to document LDM design details.

The LDM shall be tested to procedures developed by the contractor to demonstrate compliance with performance requirements established under Item 0001AA and further assess the feasibility of the design approach.

Item 0002AB Data for Item 0002AA

The data to be furnished hereunder shall be prepared in accordance with the Contract Data Requirements List, DD Form 1423, Exhibit B attached hereto.

PHASE III - OPTION 2

Item 0003AA Engineering Sensor System Advanced Development Model

The advanced development model (ADM) shall be the implementation of the design approved following the critical design review held in Phase II. The ADM shall consist of:

1. Fiber optic engineering sensors optimized and packaged for a naval application.
2. An optical telemetry link using military qualified components to the maximum extent possible.
3. A system interface device that will interface the ADM with the shipboard equipment.

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT (CONT'D)

4. The necessary electrical and optical interfaces, packaged for use in the planned environment.

The Contractor shall demonstrate the capability of the ADM telemetry subsystem to meet performance requirements with a full complement of sensors of the types applicable to the sensor system under development.

The ADM shall be tested in accordance with the test plans and procedures approved by NRL for this phase.

Item 0003AB Data for Item 0003AA

The data to be furnished hereunder shall be prepared in accordance with the Contract Data Requirements List, DD Form 1423, Exhibit C attached hereto.

PHASE IV - OPTION 3

Item 0004AA Engineering Sensor System Engineering Development Model

The engineering development model (EDM) shall be the implementation of the design approved following the critical design review held in Phase III, in a configuration which will comply with form, fit and function requirements for shipboard use. The EDM shall have functional and physical interface compatibility with the damage control, propulsion control or other ship's equipment interface for the sensor signals for the type of sensor system under development. The EDM shall be tested in accordance with the test plan and procedures approved by NRL for Phase IV and meet all requirements for laboratory and shipboard tests. Functional and physical audits of the Contractor developed critical item product specification and the level 2 drawing package with the final EDM configuration will establish the product baseline.

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT (CONT'D)

Item 0004AB Contractor Technical and Engineering Services to Support Installation and Shipboard Test and Evaluation of Item 0004AA

The Contractor shall provide the services of qualified engineering personnel and related materials to support Government personnel with shipboard installation and testing as required in the following areas:

1. Ship Check
2. Integration and checkout
3. Demonstration support
4. On-call services to resolve on-site hardware technical problems
5. On-the-job training of Government personnel
6. Design change investigations

The above services shall be supplied in accordance with specific requirements as documented, on a case-by-case basis, by the NRL Contracting Officer's Technical Representative. Subsequent written task assignments will be individually authorized and issued by the NRL Contracting Officer and acknowledged by the contractor before each service is provided. Completion of each service shall be coordinated with and processed through, the NRL Contracting Officer to insure proper accounting.

Item 0004AC Data for Item 0004

The data to be furnished hereunder shall be prepared in accordance with the Contract Data Requirements List, DD Form 1423, Exhibit D attached hereto.

STATEMENT OF WORK (SOW)
FOR A
FIBER OPTIC ENGINEERING SENSOR SYSTEM

1.0 SCOPE

The Naval Sea Systems Command (NAVSEA) has initiated a program at the Naval Research Laboratory (NRL) Fiber Optics Technology Program Office to develop and demonstrate fiber optic sensor systems in a wide range of naval engineering applications. The principal objective of this program is to develop fiber optic engineering sensors including telemetry for applications such as damage control, systems control(i.e., propulsion or steering) and intrusion defense systems for ship, aircraft, and shore applications. The near term thrust of the program is to demonstrate a system capability (including telemetry) for the measurement of a multitude of physical parameters such as fluid flow, fluid pressure, mechanical strain, electromagnetic fields, temperature, air quality, specific gravity, and liquid level.

This statement of work covers the work and program requirements for a four phased effort to install a fiber optic engineering sensor system engineering demonstration model (EDM) on a naval platform to demonstrate the advantages of fiber optics in naval applications.

EDMs for one or more different engineering sensor systems, i.e., damage control, propulsion control, or environmental control systems will be developed.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect on the date of the request for proposal form a part of the statement of work to the extent specified herein.

2.1 MILITARY SPECIFICATIONS

DOD-D-1000B Engineering Drawings and Associated Lists

MIL-C-2212F	Controller, Electric Motor, AC or DC, and Associated Switching Devices, Naval Shipboard
MIL-E-6051D	Electromagnetic Compatibility Requirements, Systems
MIL-S-8805D	Switch and Switch Assemblies, Sensitive and Push (Snap Action), General Specification for
MIL-S-16032L	Switches and Detectors, Shipboard Alarm Systems
MIL-E-16400G	Electronics, Interior Communications and Navigation Equipment, Naval Ships and Shore, General Specification For
MIL-P-24212B	Pressure Transducer Equipment, Electrical
MIL-T-24387A	Temperature Measurement Equipment Signal Conditioning and Power Supply (Electrical) (Naval Shipboard)
MIL-T-24388B	Thermocouple or Resistance Temperature Element Assemblies, General Specifications for (Naval)
MIL-L-23886A	Liquid Level Indicating Equipment (Electrical) (Naval Shipboard Use)
MIL-F-24259	Fluid Flowmeter, Volume Velocity Type
MIL-F-24291B	Flowmeter, Fluid Electromagnetic Type
MIL-D-24304A	Differential Pressure Transducer Equipment (Electrical)(Naval Shipboard Use)

2.2 MILITARY STANDARDS

DOD-STD-100C	Engineering Drawing Practices

DOD-STD-480A	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-470A	Maintainability Program Requirements (For Systems and Equipment)
MIL-STD-785B	Reliability Program for Systems and Equipment Development and Production
MIL-STD-490A	Specifications Practices
MIL-STD-881	Work Breakdown Structures for Defense Material Items
MIL-STD-961A	Military Specifications and Related Documents, Preparation of
MIL-STD-1521A	Technical Reviews and Audits for Systems, Equipments, and Computer Programs

3.0 REQUIREMENTS

The objective of this effort is to design, fabricate, test and install a fiber optic engineering sensor system containing the fiber optic sensors, optical telemetry, and system interfaces that will correct known deficiencies in currently installed engineering (damage control, system control, i.e., propulsion or steering, or intrusion defense) sensor systems. The effort shall be accomplished in four phases. Phase I shall develop a conceptual design of an engineering sensor system. One or more contractors may be involved in this process. In Phase II, a laboratory demonstration model (LDM) shall be designed, built, and tested. Phase III shall develop an advanced development model (ADM) to the system specification developed in Phase II. The ADM shall be tested in an operational type environment. An engineering development model (EDM) shall be built in Phase IV and tested onboard a naval platform. The Government retains the option to proceed or not to proceed with Phases II through IV as

circumstances dictate. The Contractor shall develop a program management plan that adheres to the phased schedule shown on page 10 of this SOW.

The Contractor shall conduct technical design reviews during each phase of the program. These design reviews will be used by the Government to assess the progress of the program and to determine whether to proceed to the next phase of the program. The technical design reviews shall be conducted in accordance with MIL-STD-1521A.

3.1 PHASE I - CONCEPT DESIGN

The Contractor shall develop a concept design of an engineering sensor system in accordance with the specifications in Section C for Contract Line Item Numbers (CLIN) 0001AA and 0001AB.

3.1.1 Technical Objectives. The concept design effort shall include:

a. Studies of an existing engineering sensor system (sensors, telemetry, and display and control equipment) to evaluate performance, reliability, maintainability, and cost effectiveness and to document known deficiencies.

b. A conceptual design of a fiber optic engineering sensor system that will correct the deficiencies identified in the concept study. Section 2.1 provides a listing of military specifications that may be used for guidance in developing system design requirements.

c. An analysis of the trade-offs between the new design concept and existing design to determine the potential for cost reduction, standardization. manufacturability, and improved performance.

3.1.2 Program Management Plan. The Contractor shall prepare a basic program management plan. The plan shall provide detailed procedures for Phase I and outline the management philosophy for Phases II through IV.

3.1.3 Reviews and Reports. The Contractor shall prepare program review documentation and conduct a System Design Review (SDR) to report the results of Phase I and to recommend one or more conceptual designs that can be implemented within the program timeframe.

The Government will assess the effectiveness and viability of the proposed design approaches. Based on the results of the SDR, the Government will approve

the concept design and determine whether to proceed or not to proceed with Phase II, the Laboratory Demonstration.

Progress and cost reports shall be submitted monthly.

3.2 PHASE II - LABORATORY DEMONSTRATION (OPTION 1)

The Contractor shall develop a laboratory demonstration model of a fiber optic engineering sensor system and other associated components in accordance with the specifications in Section C for CLIN 0002AA and 0002AB. The laboratory demonstration model shall be an implementation of the design approved at the System Design Review.

3.2.1 Technical Objectives. The laboratory demonstration model effort shall include:

a. Design, development, fabrication, test, demonstration, and delivery of a fiber optic engineering sensor system laboratory demonstration model. For the purpose of this demonstration, the engineering sensor system model shall consist of:

1. One or more fiber optic engineering sensors.
2. A fiber optic telemetry link.
3. A system interface device that will interface the fiber optic engineering sensors with the selected control and display system.
4. Electrical and optical interfaces for input power, output signals, and control circuitry.

b. Development of a System Specification in accordance with MIL-STD-490A (Type A). This specification will provide the functional baseline for the Advanced Development Model to be developed in Phase III.

c. Preparation of Level 1 drawings in accordance with DOD-D-1000B for the functional baseline system.

d. The Contractor shall prepare operating instructions for all the equipment delivered. The instructions shall be written for skilled technicians.

3.2.2 Program Management Plan. The Contractor shall update the management plan prepared in Phase I. This update shall include a system test plan for the fiber optic sensor system. A Level 3 Project Work Breakdown Structure (WBS), prepared in accordance with MIL-STD-881 shall be included in the management plan.

3.2.3 Reviews and Reports. The Contractor shall prepare program review documentation and conduct a Preliminary Design Review (PDR) to report the results of the Phase II. The Contractor shall demonstrate the Laboratory Demonstration Model at the PDR.

The Contractor shall notify the Government 15 days prior to the actual date of testing in order that a Government representative(s) may, at the Government's option, be present at the test site and witness the tests.

The Government will assess the effectiveness and viability of the proposed design approaches. Based on the results of the PDR, the Government will approve the system design and specifications, establish the functional baseline, and determine whether to proceed or not to proceed with Phase III, the Advanced Development Model Phase.

Progress and cost reports shall be submitted monthly.

3.3 PHASE III - ADVANCED DEVELOPMENT MODEL (OPTION 2)

The Contractor shall develop an Advanced Development Model (ADM) of the fiber optic engineering sensor system, in accordance with Section C Specifications for CLIN 0003AA and 0003AB. The ADM shall conform to the functional baseline and system specifications approved at the Phase II Preliminary Design Review.

3.3.1 Technical Objectives. The Advanced Development Model effort shall include:

a. Design, development, fabrication, test, demonstration, and delivery of an ADM of a fiber optic engineering sensor system. For the purposes of this demonstration, the ADM shall consist of:

1. Fiber optic engineering sensors optimized and packaged for a naval application.
2. An optical telemetry link using military qualified components to the maximum extent possible.
3. A system interface device that will interface the ADM with the shipboard equipment.
4. The necessary electrical and optical interfaces, packaged for use in the planned environment.

b. Development of a Critical Item Development Specification (CIDS)(Type B2) in accordance with MIL-STD-490A and MIL-STD-961A.

c. Updating the Level 1 drawings.

d. Testing of the ADM in an environment that simulates the intended operational environment of the system.

3.3.2 Program Management Plan. The Contractor shall update the program management plan. This revision shall include an update of the system test plan.

3.3.3 System Test Procedures. The Contractor shall prepare test procedures for the ADM. These procedures shall be updated in Phase IV.

3.3.4 Integrated Logistics Support Plan. The Contractor shall prepare an Integrated Logistics Support Plan (ILSP) to include:

a. Reliability and Maintainability Plan

b. Contractor Support Services for Phase IV Installation & Checkout

c. System Operating and Maintenance Instructions.

The reliability and maintainability (R&M) program shall be established in accordance with MIL-STD-470 and MIL-STD-785. The full ILSP shall be implemented in Phase IV.

3.3.5 Configuration Management Plan. The Contractor shall prepare a Configuration Management (CM) Plan in accordance with DOD-STD-480A that will define the configuration management that will be implemented in Phase IV to identify and control the product baseline for the EDM configuration item.

3.3.6 Electromagnetic Compatibility Plan. The Contractor shall develop and implement a comprehensive program to demonstrate that the system will perform its functions in its operational electromagnetic environment.

3.3.7 Reviews and Reports. The Contractor shall prepare program review documentation and conduct design reviews every two months. The first program review shall be a Preliminary Design Review (PDR) to review the ADM design. The Government will assess the effectiveness and viability of the proposed design approaches. Based on the results the PDR, the Government will approve the ADM design. The functional baseline will be established at this time.

The Contractor shall prepare a program review documentation and conduct a Critical Design Review (CDR) after the factory acceptance test to report the results of Phase III. The Contractor shall demonstrate the ADM at the CDR.

Progress and cost reports shall be submitted monthly.

3.4 PHASE IV - ENGINEERING DEVELOPMENT MODEL (OPTION 3)

The Contractor shall develop an Engineering Development Model (EDM) of the fiber optic engineering sensor system in accordance with Section C Specifications for CLIN 0004AA and 0004AB. The EDM will be tested on a naval platform. The EDM shall conform to the functional baseline (CIDS) approved at the Phase II Critical Design Review.

3.4.1 Technical Objectives. The Engineering Development Model effort shall include:

a. Design, development, fabrication, test, demonstration, and delivery of an EDM of a fiber optic engineering sensor system. For the purposes of this demonstration, the EDM shall consist of:

1. Fiber optic engineering sensors packaged for a naval application.
2. An optical telemetry link using military qualified components to the maximum extent possible.
3. A system interface device that will interface the EDM with the shipboard equipment.
4. The necessary electrical and optical interfaces, packaged for use in the planned environment.

b. Development of a Critical Item Product Specification (CIPS)(Type C2) in accordance with MIL-STD-490A and MIL-STD-961A.

c. Development of Level 2 drawings.

d. Implementation of configuration management including product baseline documents, installation control drawings, and engineering documents in accordance with DOD-STD-480A.

e. Implementation of ILSP procedures including quality assurance, R&M, safety, development of technical publications, and training.

f. Installation of the EDM on a naval platform.

g. Testing of the EDM on the naval platform.

3.4.2 Program Management Plan. The Contractor shall update the program management plan. This revision shall include plans for ship checks, installation and checkout, and shipboard testing of the fiber optic engineering sensor system.

3.4.3 System Test Procedures. The contractor shall prepare test procedures for the EDM. These procedures shall include the shipboard test procedures.

3.4.4 Integrated Logistics Support Plan. The Contractor shall implement the Integrated Logistics Support Plan (ILSP) approved in Phase III including the:

a. Reliability and Maintainability Plan
b. Baseline Management Plan

3.4.5 Configuration Management. The Contractor shall implement the Configuration Management (CM) Plan developed in Phase III and conduct functional and physical configuration audits to verify that the EDM complies with the requirements of the CIPS and to establish the Level 2 drawing package as the product baseline.

3.4.6 Electromagnetic Compatibility (EMC) Plan. The Contractor shall update the EMC Plan to include the actual environment expected on the ship.

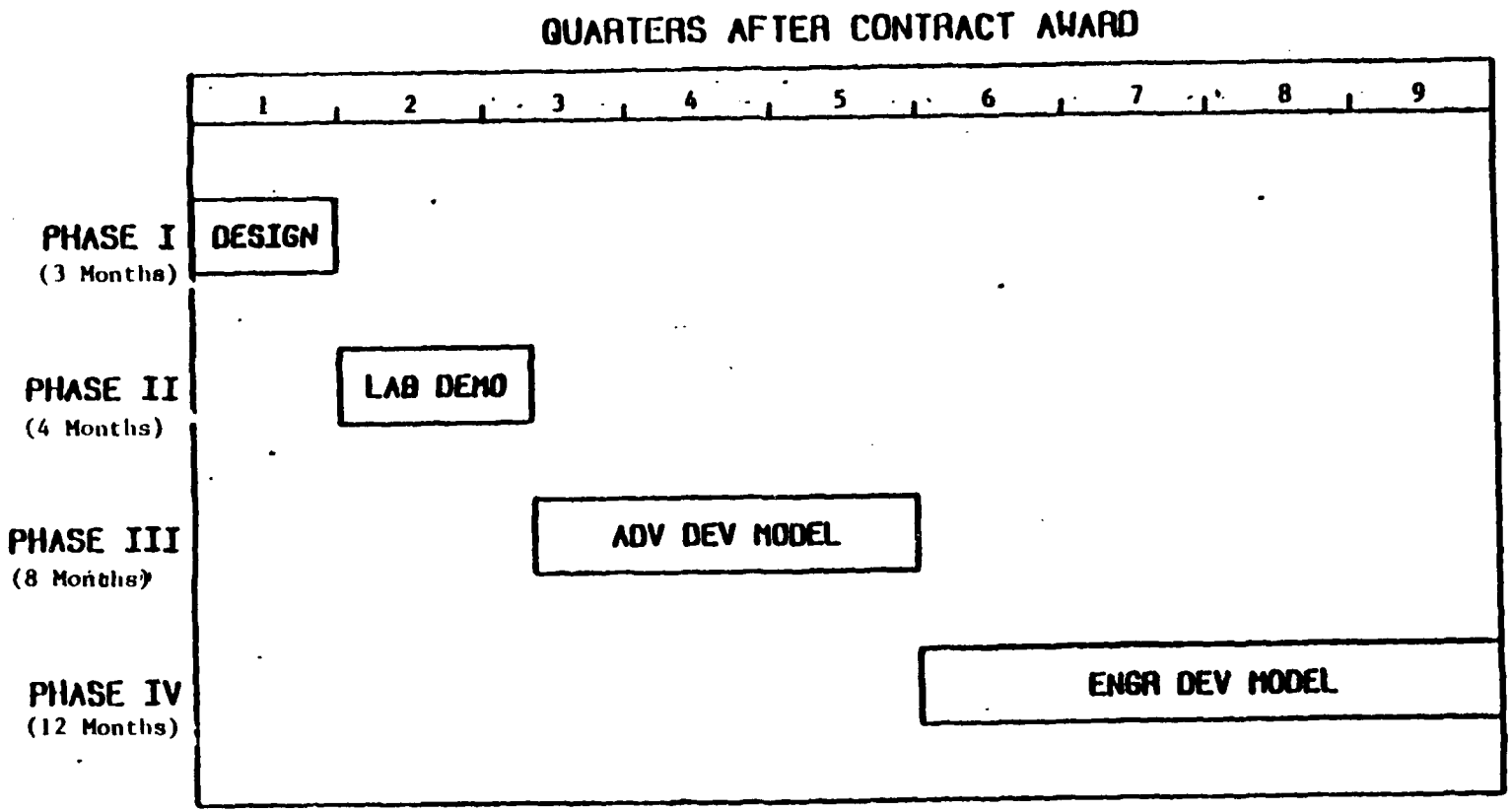
3.4.7 Reviews and Reports. The Contractor shall prepare program review documentation and conduct design reviews every two months throughout Phase IV.

The Contractor shall prepare a report reporting the results of the shipboard tests.

The Contractor shall prepare a final report describing the results of the program. This report shall include the system description, critical item product specification, Level 2 drawings, preliminary ILS documents, CM documents, technical manuals, and training documents.

Progress and cost reports shall be submitted monthly.

FIBER OPTIC ENGINEERING SENSOR SYSTEM



Appendix B

FOESS

WORK BREAKDOWN STRUCTURE

FOESS WORK BREAKDOWN STRUCTURE

WBS #			DESCRIPTION
1000			PROGRAM MANAGEMENT
2000			DATA
3000			PHASE 1: CONCEPT DESIGN
	3100		EVALUATE CURRENT SYSTEM
		3110	DESCRIBE CURRENT SYSTEMS
		3111	IDENTIFY SENSORS
		3112	COLLECT DATA
		3120	EXTRACT FOESS REQUIREMENTS
		3121	SENSORS
		3122	TELEMETRY
		3123	CONTROLS & DISPLAYS
		3130	ESTABLISH TRADE-OFF DATA BASE
	3200		CONCEPT DESIGN
		3210	USAS
		3211	SELECT TOPOLOGY
		3212	SPECIFY COMPONENTS
		3213	NETWORK DESIGN
		3220	FOESS SENSORS
		3221	SURVEY EXISTING FIBEROPTIC SENSING TECHNOLOGY
		3222	ANALYZE & SELECT FIBEROPTIC SENSING FUNCTION
		3223	SPECIFY BASIC FIBEROPTIC TRANSDUCER DESIGN
		3224	SPECIFY CONVERSION MODULE DESIGNS
		3230	CONTROLS & DISPLAY
		3231	MAN-MACHINE REQUIREMENTS
		3232	DATA ACQUISITION AND SIGNAL PROCESSING

FOESS WORK BREAKDOWN STRUCTURE

WBS #		DESCRIPTION
	3240	SYSTEM DESIGN INTEGRATION
	3241	INTEGRATE DESIGN
	3242	DEVELOP DRAFT SYSTEM DESIGN REVIEW DATA PACKAGE
	3243	DEVELOP FINAL SYSTEM DESIGN REVIEW DATA PACKAGE
	3244	IDENTIFY CRITICAL DESIGN ISSUES
3300		TRADE-OFF ANALYSIS
	3310	DEFINE NOTIONAL CURRENT SYSTEM
	3311	FUNCTIONS & COMPONENTS
	3312	PARAMETERS
	3320	DERIVE FOESS DATA
	3330	CURRENT vs FOESS SYSTEM TRADEOFF
	3340	CONCEPT DESIGN UPGRADE
3400		CONTROL AND DISPLAY
	3410	MAN/MACHINE INTERFACE
	3420	DATA ACQUISITION AND SIGNAL PROCESSING
3500		LABORATORY DEMONSTRATION PLAN
4000		PHASE II: LABORATORY DEMONSTRATION
5000		PHASE III: ADVANCED DEVELOPMENT MODEL
6000		PHASE IV: ENGINEERING DEVELOPMENT MODEL
7000		TESTING AND EVALUATION
8000		SUPPORT

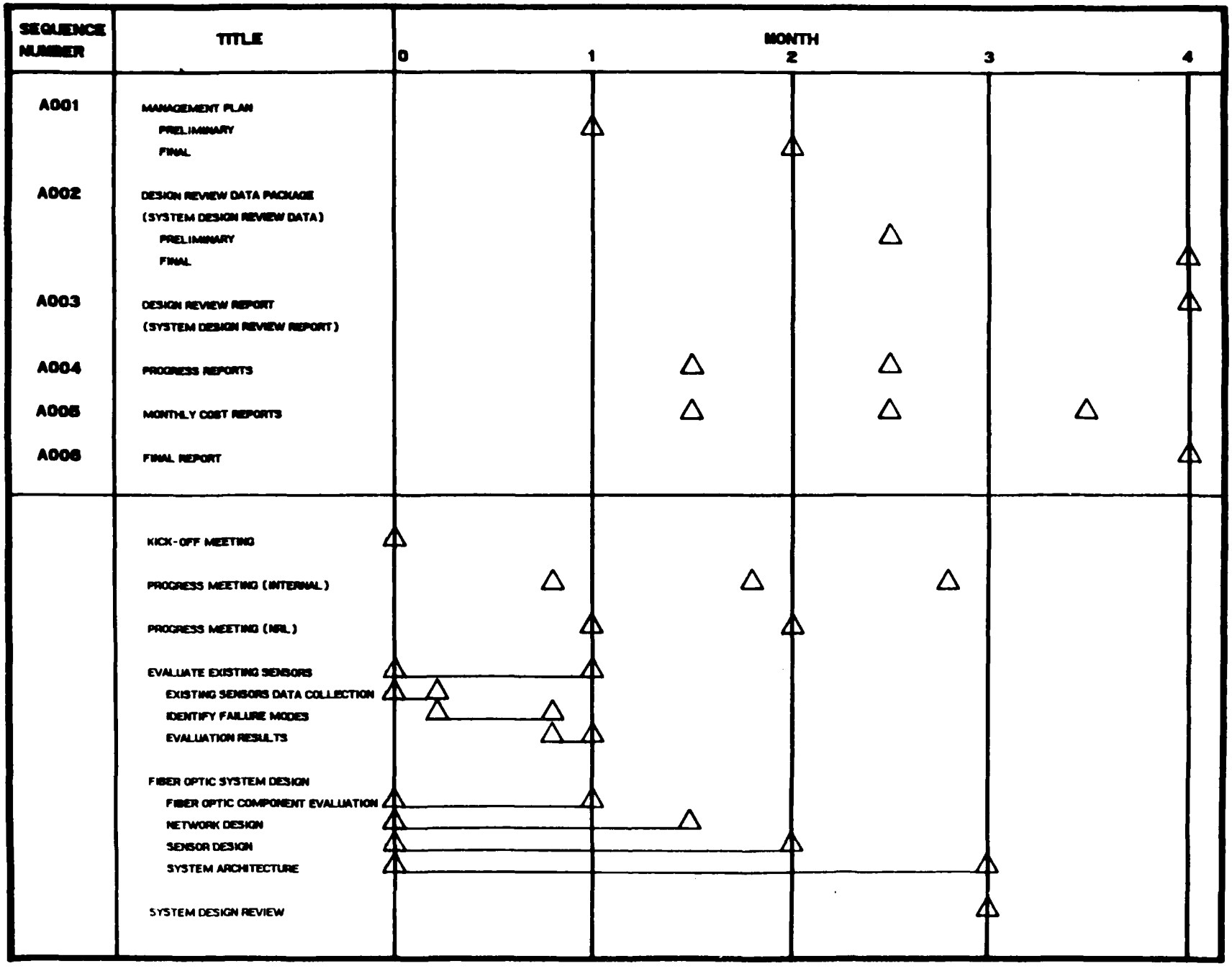
Appendix C

FOESS

PHASE I

MILESTONE SCHEDULES

PHASE I


SEQUENCE NUMBER
TITLE
MONTH
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1
2
3
4
A001
MANAGEMENT PLAN
PRELIMINARY
FINAL
A002
DESIGN REVIEW DATA PACKAGE
(SYSTEM DESIGN REVIEW DATA)
PRELIMINARY
FINAL
A003
DESIGN REVIEW REPORT
(SYSTEM DESIGN REVIEW REPORT)
A004
PROGRESS REPORTS
A005
MONTHLY COST REPORTS
A006
FINAL REPORT
KICK-OFF MEETING
PROGRESS MEETING (INTERNAL)
PROGRESS MEETING (NRL)
EVALUATE EXISTING SENSORS
EXISTING SENSORS DATA COLLECTION
IDENTIFY FAILURE MODES
EVALUATION RESULTS
FIBER OPTIC SYSTEM DESIGN
FIBER OPTIC COMPONENT EVALUATION
NETWORK DESIGN
SENSOR DESIGN
SYSTEM ARCHITECTURE
SYSTEM DESIGN REVIEW

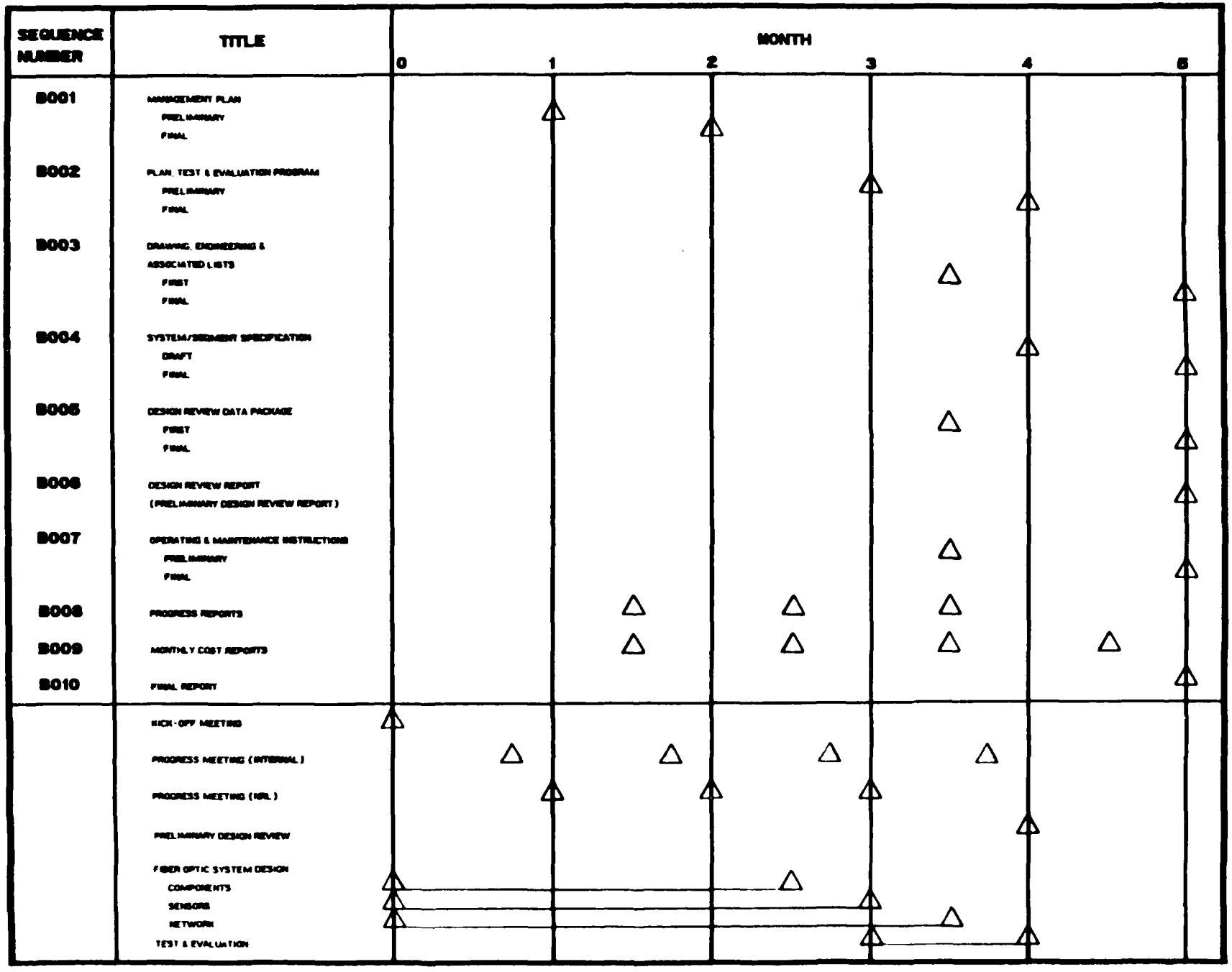
Appendix D

FOESS

PHASES II - IV

MILESTONE SCHEDULES

PHASE II


SEQUENCE NUMBER
TITLE
MONTH
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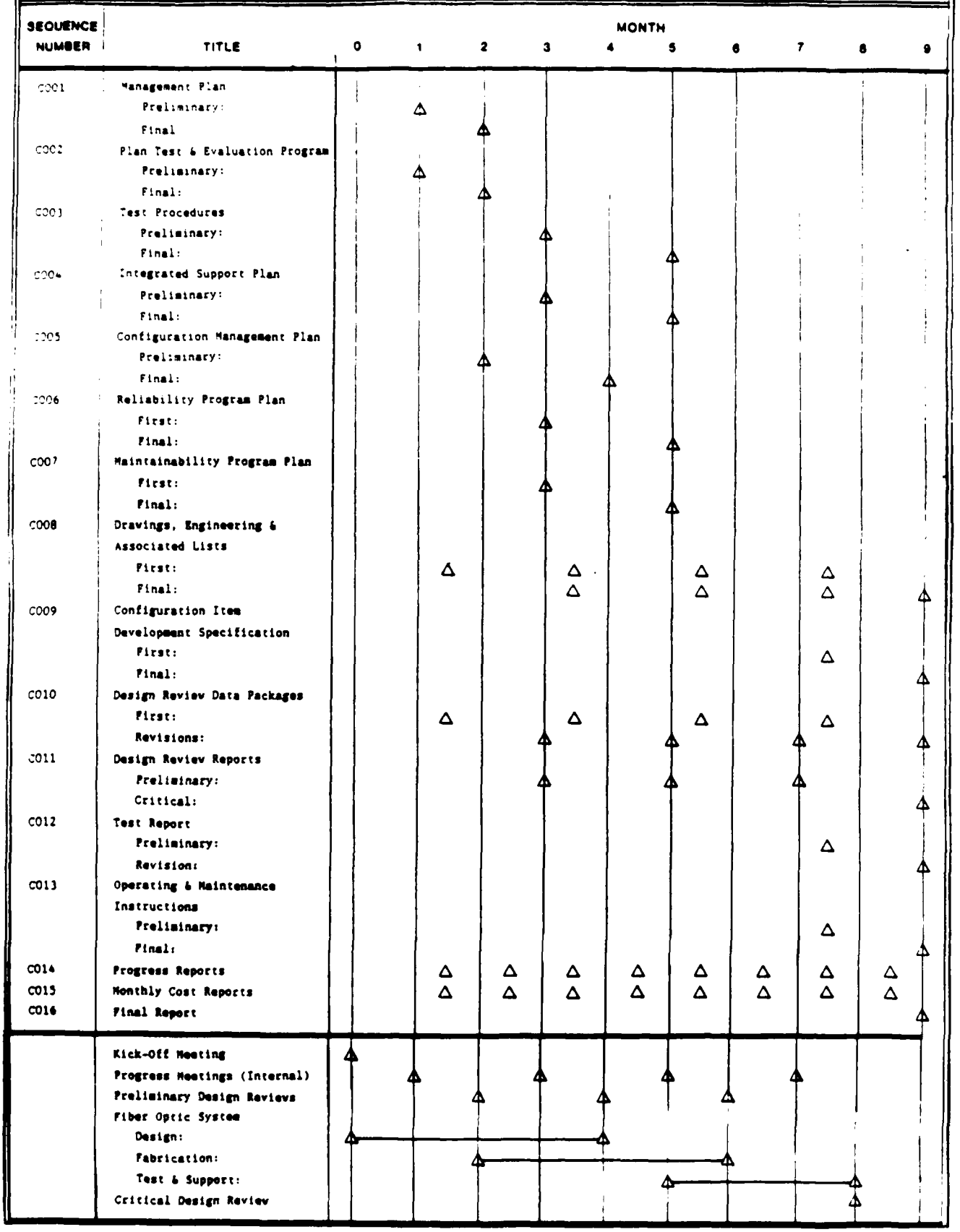
2
3
4
5
B001
MANAGEMENT PLAN
PRELIMINARY
FINAL
B002
PLAN, TEST & EVALUATION PROGRAM
PRELIMINARY
FINAL
B003
DRAWING, ENGINEERING & ASSOCIATED LISTS
FIRST
FINAL
B004
SYSTEM/SEGMENT SPECIFICATION
DRAFT
FINAL
B005
DESIGN REVIEW DATA PACKAGE
FIRST
FINAL
B006
DESIGN REVIEW REPORT
(PRELIMINARY DESIGN REVIEW REPORT)
B007
OPERATING & MAINTENANCE INSTRUCTIONS
PRELIMINARY
FINAL
B008
PROGRESS REPORTS
B009
MONTHLY COST REPORTS
B010
FINAL REPORT
KICK-OFF MEETING
PROGRESS MEETING (INTERNAL)
PROGRESS MEETING (NRL)
PRELIMINARY DESIGN REVIEW
FIBER OPTIC SYSTEM DESIGN
COMPONENTS
SENSORS
NETWORK
TEST & EVALUATION

PHASE III


SEQUENCE NUMBER
TITLE
MONTH
0
1
2
3
4
5
6
7
8
9
C001 Management Plan
Preliminary:
Final
C002 Plan Test & Evaluation Program
Preliminary:
Final:
C003 Test Procedures
Preliminary:
Final:
C004 Integrated Support Plan
Preliminary:
Final:
C005 Configuration Management Plan
Preliminary:
Final:
C006 Reliability Program Plan
First:
Final:
C007 Maintainability Program Plan
First:
Final:
C008 Dravings, Engineering & Associated Lists
First:
Final:
C009 Configuration Item Development Specification
First:
Final:
C010 Design Review Data Packages
First:
Revisions:
C011 Design Review Reports
Preliminary:
Critical:
C012 Test Report
Preliminary:
Revision:
C013 Operating & Maintenance Instructions
Preliminary:
Final:
C014 Progress Reports
C015 Monthly Cost Reports
C016 Final Report
Kick-Off Meeting
Progress Meetings (Internal)
Preliminary Design Reviews
Fiber Optic System
Design:
Fabrication:
Test & Support:
Critical Design Review

PHASE IV

SEQUENCE NUMBER	TITLE	MONTH 0 1 2 3 4 5 6 7 8 9 10 11 12 13
D001	Management Plan	
	Preliminary:	△
	Final:	△
D002	Test & Evaluation Program Plan	
	Preliminary:	△
	Final:	△
D003	Test Engineering Procedures	
	Preliminary:	△
	Final:	△
D004	Design Review Data Packages	
	First:	△ △ △ △ △ △
	Revision:	△ △ △ △ △
D005	Design Review Reports	△ △ △ △ △
D006	Configuration Item Product Function	
	Preliminary:	△
	Final:	As required
D007	Drawings, Engineering & Associated Lists (Level 2)	
	Preliminary:	△
	Final:	As required
D008	Drawings, Engineering & Associated Lists (ICD)	
	Preliminary:	△
	Final:	△
D009	Test Reports	As required
D010	Configuration Audits	
	Agendae:	As required
	Reports:	As required
D011	Operating & Maintenance Instructions	
	Preliminary:	△
	Final:	△
D012	Progress Reports	△ △ △ △ △ △ △ △ △ △ △ △
D013	Technical Report (Final Report)	
	Preliminary:	△
	Final:	△
D014	Monthly Cost Reports	△ △ △ △ △ △ △ △ △ △ △ △ △
	Kick-Off Meeting	△
	Progress Meetings (Internal)	△ △ △ △ △
	Progress Meetings (NRL)	△ △ △
	Test Procedure (Final)	△
	Fiber Optic System	
	Design Upgrade	△ — △
	Fabricate	△ — △
	Test	△ — △
	Install	△ — △
	Test Shipboard	△ — △
	Shipboard Test (EST)	△ — △
	Design Review	△ △ △ △ △
	Update Phase III Plans	△ △ △ △
	Sensor System	

END

DATE

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